UNIVERSITY OF CALIFORNIA.

AGRICULTURAL EXPERIMENT STATION.

BULLETIN NO. 8.

[In order to render the results of investigations and experiments conducted by the Agricultural Department of the University of California more quickly and more generally available than has heretofore been done through the annual or biennial reports, it is proposed to embody hereafter, in the form of "Bulletins," to be issued as often as may seem desirable, reports of results, as well as such other discussions, information or answers to questions as may be of general interest. It is intended to make these bulletins, as a rule, short enough for insertion in the daily or weekly papers of the State, and proof-slips of the same will be regularly mailed to papers applying therefor. The substance of these bulletins will ultimately be embodied in a more complete and connected form, in the annual reports of the College of Agriculture.]

Examinations of Fertilizing Materials.

1. *Analysis of the Ash of Spent Tan-bark.*—This material is sometimes obtainable in considerable quantities from neighboring tan-yards; and the sample was furnished by Mr. John H. Wheeler, Secretary of the Board of Viticultural Commissioners, with a view to ascertaining its manurial value and especially its adaptation as a fertilizer for vines.

The ash contained some unburnt matter which was not determined directly. In the table below, column 1 shows the composition of the material after drying at the boiling point of water; column 2 shows the composition as it would be if burnt completely and at a higher heat, so as to "burn" the lime into quicklime:

	1.	2.
Insoluble residue	5.68 per cent	8.87 per cent
Potash	2.90 per cent	4.53 per cent
Soda	3.36 per cent	5.25 per cent
Lime	41 40 per cent	64.62 per cent
Magnesia	5.02 per cent	7.83 per cent
Iron and alumina	4.67 per cent	7.29 per cent
Br. ox. manganese	.31 per cent	.48 per cent
Sulphuric acid	.26 per cent	.40 per cent
Phosphoric acid	.47 per cent	.73 per cent
Carbonic acid	27.67 per cent	.....
Organic matter and loss	8.26 per cent	.....
Total	100.00	100.00

It will be noted in column 1 that lime (in the form in which it exists in air-slaked lime, in combination with carbonic acid and water) constitutes the bulk of this ash, while the ingredients of chief importance as mineral plant food, viz.: potash and phosphoric acid, are present in small amounts only as compared with the ash of oak wood, or of fresh bark. This change is partly the result of the leaching the bark has undergone in the tan-pits, partly that of the use of lime in dressing the hides. Assigning to the 58.0 pounds potash and 9.4 pounds of phosphoric acid contained in a ton of the raw ash, the valuation usually made in the case of commercial fertilizers, it would be worth about $6.36 per ton on that score; but where lime is needed it might be valued from eight to ten dollars for actual use. Potash is especially needful for the maintenance of production in older vineyards, but as a rule it is abundant in fresh soils in California; while phosphoric acid is, on the whole, but in small supply.

2. *Analysis of the Lime Refuse from the Alvarado Sugar Works.*—This is the by-product of the defecation of the beet juice with lime, and, of course, it consists in the main of lime in the air and water-slaked condition. The object of the analysis made at the suggestion of Mr. John L. Beard, of Centerville, was to ascertain the amounts of phosphoric acid and ammonia, or other nitrogen compounds that have been taken up from the beet juice and would be in a highly available condition as fertilizers. The substance is a grayish paste, of an offensive odor, in which the presence of ammonia is, however, easily perceived. Hence it is obviously losing in manurial value continually, as it lies exposed to the air. In drying it for analysis, this loss, of course, was also increased. The determination gave:

Phosphoric acid in air-dried mass..... 1.57 per cent.
Ammonia (determined as nitrogen)..... .67 per cent.

From the condition of the mass when received, it may be inferred that quite one-half, if not more, of the nitrogen originally contained in the fresh mass had already evaporated in the shape of ammonia gas.

Considering that the two ingredients thus derived from the beet juice are present in a highly effective condition, it is certainly worth the while of those living near the factory to haul this refuse upon their fields, or to use it in composting, especially with the tule muck, or marsh soil, which will thus be sweetened by the lime, and will serve to retain the ammonia. The latter object may also be attained by using some plaster in the compost. Aside from the lime, the value of the dry material, as shown in the analysis, is about eight dollars per ton, according to the usual schedule.

Examinations of Soils.

Granite Soils from the Foothills of the Sierra Madre, Los Angeles County.—Sent by Mr. Wm. A. Spalding, of Sierra Madre, who says that such land forms a kind of sloping mesa, "the natural growth being greasewood, white sage, sumac, lupins, etc., with an occasional sycamore. The brush is naturally heavy, and often swept by fires. The soil is easily cultivated, and does not differ obviously from the subsoil; drinks up all the water that can be put upon it, but retains moisture well during the hot summer. Deciduous trees and grape vines flourish without any irrigation, provided they are fairly cultivated; citrus trees do finely, but it is not well suited to grasses, clovers, corn, grain, root crops or garden vegetables." It is especially desired to know the cause of the latter defect and its possible remedy.

This soil is rather coarsely granular or sandy, the grains being obviously largely granite de-

bris. This fact renders a full analysis unnecessary, since such soils are known to contain abundance of potash and, in California, of lime. A special determination proved that it also contains an adequate supply of phosphoric acid. It is therefore obvious that its defect is a mechanical one, and this was verified by mechanical analysis, the soil being passed successively through sieves of increasing fineness, upon which there remained the following percentages of sand too coarse to pass :

	Per Cent.
Sieve with meshes of 1-12th inch retained	30.4
Sieve with meshes of 1-25th inch retained	20.6
Sieve with meshes of 1-50th inch retained	17.0
Sieve with meshes of 1-60th inch retained	12.3
Finer than 1-60th inch, or "fine earth"	19.7
	100.0

This fine earth was found to contain 4.7 per cent of true clay, which referred to the entire soil, shows the latter to contain only about nine tenths per cent of clay.

This fact explains fully why the shallow-rooted grasses, vegetables, etc., will not grow well on this soil. The surface soil, upon which they mainly depend for their nourishment, is too coarse to afford it, contains too little fine matter from which their roots can draw sustenance, and is also too open to the dry summer atmosphere. The fine matters are constantly carried by the rain or irrigation water to greater depths, where the roots of trees, vines and tap-rooted plants can follow them, and find moisture at the same time.

It is not easy to suggest a remedy for this state of things that would be applicable on the large scale. For small garden plots, flower-beds, etc., the hauling of a more clayey soil on the surface may be feasible. Another expedient is the one employed by the Arabs, viz.: to plant in pits so as to bring the shallow roots within reach of a more compact soil and abundant moisture. But for practical purposes, the culture naturally adapted to these circumstances will have to prevail.

Soil form Capay Valley.—Sent by Mr. E. W. Thomas of Capay. This soil is evidently old alluvium of Cache Creek, substantial but light and somewhat gravelly, with a gravelly subsoil. Mr. Thomas desired to have some definite data as to its adaptation to fruit culture, and prospective durability. The only points needing determination in this case were the amounts of lime and phosphoric acid present, which were found to be as follows.

Lime	7.35 per cent
Phosphoric acid	1.04 per cent

As the rocks of the valley are known to contain abundance of potash, and the above percentages are quite satisfactory, there can be no doubt of the adaptation of the soils to the purpose intended, nor of fair durability.

Berkeley, March 6, 1884. E. W. HILGARD.